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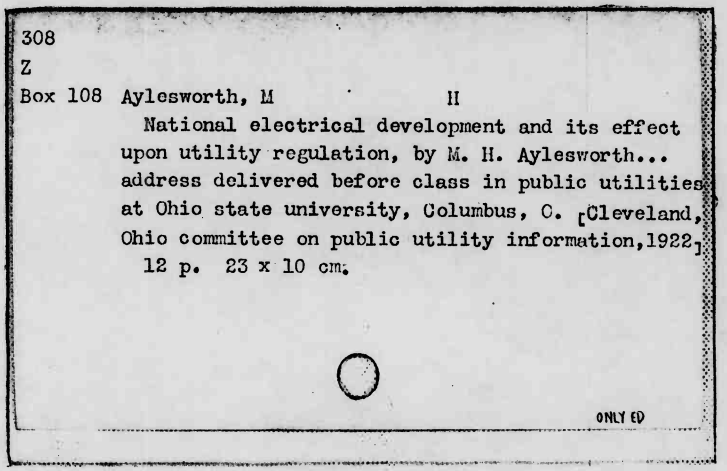

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By

M. H. AYLESWORTH

Executive Manager
National Electric Light
Association

Address delivered before Class in
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CB may 31, 1923
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National Electrical Development
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WHEN Edison, on October 21, 1879, produced in his laboratory at Menlo Park, New Jersey, an incandescent lamp with a filament of carbonized cotton sewing thread, he little dreamed of the great electric light and power industry that would spring into birth as a result of his discovery.

At that time the series arc lamp now little used had established itself for street lighting, but there was no multiple system of low voltage for interior illumination whereby one lamp could be lighted or extinguished independently of all the others in the circuit.

What Edison in his epoch-making invention succeeded in doing was to make electric light divisible, thus producing something smaller, safer, better and more practical for general electric service.

The commercial promotion of the direct dynamo and motor came quickly on the heels of this development of the incandescent lamp followed by the perfection of the alternating current system of electric generation, transformation and distribution.

Pioneer Electric Light and Power Stations

The modern system of electric supply from a central source was inaugurated at a time within the memory of men still living and active. On an ordinary brick structure on Pearl Street, New York, is a bronze tablet with this inscription: "In a building on this site an electric plant supplying the first Edison underground central station system in this country and forming the origin of New York's present electrical system,

began operation on September 4, 1882, according to plans conceived and executed by Thomas Alva Edison."

About the same time another Edison generating station was started in Appleton, Wisconsin, and while the dynamos in New York were driven by steam engines, water wheels were used to drive the electric generators at Appleton. Strange as it may seem, the first central electric light and power station blazed the way for the best steam central station practice of today, just as the general arrangement and salient features of the first electric incandescent lamp still persist;—a marvelous tribute to the skill and genius of Edison.

Introduction of Alternating Current

At first the Edison companies were to be found only in a few cities and engaged exclusively in the lighting business. The lamp hour was the unit of measurement at that time and one cent a lamp hour was considered a very fair charge. The kilowatt-hour as a unit of measurement was not heard of until 1893-1894. With the production of commercial electric motors, the application of Edison electric service was considerably broadened although because of the low voltage there were distinct limitations on the distance to which direct current could be carried from the central station.

A revolution in the art of electric generation distribution took place in 1885, with the introduction of the alternating current system. The invention of polyphase apparatus by Nikola Tesla extended the use of alternating current still farther and gave incalculable value to water power development. As a direct result of the introduction of alternating current there sprang up the immense network of high-tension lines which now traverse all parts of the country.

Marvelous Growth of the Electrical Industry

Beginning with 1890, expansion in electrical art and science became very marked. Electric power stations grew larger and larger and more truly performed their functions as a central source of all electrical supply. Engineering practices were standardized and developed, and invention had hard work to keep pace with the ever-increasing needs of the industry. Small reciprocating engines were replaced by steam turbines which grew in size from 5000 H.P. to 60,000 H.P. in less than a decade. Transmission voltages increased with like rapidity from 33,000 to 220,000 volts and the maximum distance of transmission from a few miles to many hundred miles.

In 1906 the carbon filament lamp was displaced by the tungsten filament lamp and more recently by the nitrogen filled lamp which gives more than five times the illumination per watt than the old carbon lamp. The number of electric central stations increased to over 5000, ranging in rating from a few hundred horsepower to 300,000 H.P., and the variety of uses to which electricity has since been put has eclipsed the wildest dreams of its pioneers. Due to the cumulative effect of more and more light and greater and more diversified uses of motors and electric heating apparatus, the output of electric central stations increased by leaps and bounds. In 1902 it was 2,500,000,000 K.W. Hrs. but it kept on doubling every five years, and the last United States Census taken in 1917, gave the kilowatt hour output of the electric central stations in the country as twenty-five billion four hundred and forty million. In 1921, the estimated output was over 43 billion K.W. Hrs. Thus an industry unknown less than two score years ago now ranks among the most important in the world.

Consolidation of Power Companies

Turning now from this brief summary of the stages of progress in the electric light and power field, let us trace the evolution of independent companies or systems into interconnected or correlated groups and note the trend of developments. To begin with, the impelling and underlying motive for constant improvement in the electric light and power field is service. Service is the shibboleth of that industry. All its traditions cluster around it and all its energies are bent to make it, within human limitations, perfect.

Electric power plants supply a service—not a commodity, and since no economic method has yet been devised for storing electrical energy in large quantities, electric power generation must be coincident with the demand for electricity and vary according to that demand. Every power plant must therefore not only have installation sufficient to meet the maximum demands, but must also have a certain percentage of excess installation for the purpose of anticipating increases in markets and to insure continuity of service in case of accident.

The relation between the actual equipment

used and the maximum equipment installed determines the load factor. This load factor, or ratio of utilization of installation, is of the greatest importance in the electric power business. Certain charges upon the power plant, such as interest, insurance, taxes, and to a considerable extent, depreciation, are constant, regardless of the amount of electricity produced. Even operating charges become less per unit of output as the quantity of electricity produced increases and every means which may be employed to increase the percentage of the utilization necessarily decreases the cost of the business. Different classes of users have different kinds of maximum demand and the larger the market supplied, the greater this diversity. To secure the advantages attendant upon diversity of demand is one of the chief reasons for the existence of the electric central station and constitutes the chief motive for joining many plants and many markets into one combined system.

Formation of Holding Companies

The realization that small local plants operating independently could not fully serve their communities came fifteen years ago. There was no escaping the fact that small companies could not risk investment for the fluctuating supply of electricity to large users, nor could they at times command sufficient funds for the adequate extension of their systems. If the industry was to expand and grow and come up to the expectation of its leaders, something had to be done. Consolidation was realized by the clearsighted to be an ultimate and inevitable necessity. In the very nature of things this gave rise to what is known as the holding company, a corporation which owns the securities or properties of local operating central stations. The latter are sometimes contiguous and are joined by transmission lines Sometimes they are located largely in one state or scattered through many states, but whatever their number or location, one central management provides the necessary finances for growth, standardizes engineering practices and construction, and consolidates purchases, all of which trends for lower costs. The economies which result from such an arrangement are many.

It is evident that while a single generating station may take advantage of the diversity factor of the various industries located in the community, a larger station serving many communities or a system of interconnected stations

has the added advantage of the diversity factors of the industries and activities of many communities. Under a former and to some extent still existing condition of power generation, particularly in industrial and populous districts, there is a serious waste of resources and a heavy expense for labor and materials for power production that can be and should be eliminated by centralization of power generation, by unifying the operation of the systems and by discontinuing power production in inefficient plants. Moreover, where there are water power resources, these should be developed and interconnected with existing systems for the best interchange of facilities to secure the highest economy and reliability of service. Thus, wider and wider interconnection of stations and systems is the order of the day, and it is only through the operations of the holding company that such consolidations and interconnections can be effected. Indeed, it is the holding company that has made twenty-four hour service possible in many small towns and it is to the holding companies that other rural communities and the farmer must eventually look for service. Were it not for the existence of such central organizations electric service would be greatly restricted and the rates therefor would be much higher than they are now.

Customer Ownership of Utilities

There is another phase in the modern development of the public utility industry in which holding companies play a very important part.

Since the manifest failure of Government and municipal ownership and operation, which in most instances has proved to be political ownership and operation, there is gradually being worked out the real public ownership of utilites through investment in their securities by the general public, particularly the customers served.

It is becoming generally recognized by company officials and the general public as well, that it is a most helpful thing for the millions of utility customers to become their own partners in public service enterprises through investment.

The holding companies, through their larger organizations and more highly developed sales and advertising organizations, have taken a conspicuous lead in customer ownership campaigns. And on account of this superior permanent organization they are generally able to secure contact with a larger proportion of the investing public than would a single company working independently and without a central, well estab-

lished force banded together for the purpose of constantly stimulating interest in the customer ownership idea.

This home ownership of public service properties by reason of a wide distribution of utility securities in almost all localities served by holding companies, has also tended to bring about and cement a more sympathetic understanding between the public served and the utility rendering such service.

The number of stockholders in electric light and power companies is constantly growing, the last estimate being that there are now 1,500,000 holders of the securities of such companies in the United States. This great growth in furtherance of the public ownership idea hardly would have been possible without the superior facilities of the holding companies.

Formation of Super Power Systems Through Interconnection

The advantages of interconnection of large power systems, which are in themselves self-sustaining, and whose generating plants are already interconnected by tie and distribution lines, for independent economical operation, are many. Interconnection not only increases the reliability of operation, it reduces the total reserve capacity required for an interconnected system over the aggregate amount required in separately-operated systems and utilizes that reserve capacity to better advantage. Moreover in cases of hydro electric plants, it enables the company to take advantage of the diversity of the natural stream flow between drainage areas, and to reduce the amount of reserve steam power necessary to guarantee continuous service. By means of interconnection the most efficient plants may be operated at a maximum to supply any great amount of steam power required in the combined system from the viewpoint of economy and coal transportation. Newly constructed plants may also be loaded in a shorter time and may be located at more economic sites, such as coal producing centers and points accessible to condensing water. Not the least of the many advantages of interconnection is the fact that water powers otherwise unavailable are made serviceable for the use of man.

Already great strides have been made in interconnection, and striking examples of super power districts are to be found in the Middle West, on the Pacific Coast, in the New England States, and in the Southern and Southeastern districts. In California, physical interconnection has made possible the interchange of electricity by companies operating between Vancouver, British Columbia, to a point several miles below the Mexican border.

In the history of zone physical interconnection, two outstanding facts appear. First, the service has been improved or maintained at the highest point of efficiency without the necessity for proportionately increased rates; and second, ability to furnish service which otherwise would not be possible has resulted in increased demands with increased benefits to those securing the service. As these zone networks come into being, they bring electric light and power closer and closer to the farm. They make it possible for companies operating in one or more communities and physically interconnected with properties operated in other communities to extend a distribution system into suburbs and even into rural centers where the demand for service is sufficiently great to justify it and the construction cost is within reason.

Electric Service No Longer Local But State-Wide

From these facts it may readily be seen that the electric light and power industry is no longer local, in that it furnishes only the people residing within the boundaries of any one community, but, on the contrary, is an actual or potential state-wide industry, serving a multiplicity of communities and extending sooner or later to every farm and every ranch. When this comes to pass it will not only benefit the farmer and his family and hired help, but also benefit the communities upon which the farm and farmers are dependent for their markets and which in turn are dependent upon the farm and farmers for the necessities of life.

Evolution of Regulation

With the gradual recognition on the part of the public that electric service to be efficient and economical must be monopolistic, came the necessity for some control which, while protecting the monopoly, would guarantee service at rates that were reasonable and just to all parties concerned. This gave rise to administrative bodies, charged with the enforcement of specific laws and endowed with regulatory and sometimes quasi-

judicial powers, or in other words, public service commissions.

Although the formation of these commissions might seem at first sight a step away from popular government, the closeness of their relation with the interests put in their charge enables the public feeling and the public wish to be expressed clearly and forcibly to those who have authority to act. Upon the whole, their creation has been very happy since it enables improvements to be effected with a minimum of friction and with a promptness almost impossible of attainment by any other means. The granting of such powers by the Legislature does not imply any hostility on the part of the government to public utility organizations. On the contrary, it is the express duty of the commissions in administering their office to conserve the interests of both the stockholder and the public.

Formation of Public Service Commissions

Public utility regulation of a state wide character in the United States dates from the establishment of the Massachusetts Gas and Electric Light Commission in 1885. Unfortunately that Commission had relatively little power at the outset, although its authority was materially strengthened with the passing years. The first public utility commissions of wide scope and power date from the establishments of the Public Service Commission of New York State, in 1907, and with the enlargement of powers and duties of the Wisconsin Railroad Commission the same year. The example set by these two states and the success attained by their commissions led other states to create commissions or enlarge the powers of old ones. At the present time, there is only one state in the Union which does not possess a public regulatory body of some sort.

As a rule these commissions exercise supervision over the quality of the service and the rates to be charged therefor. In order to safeguard the investing public and to prevent unduly high charges to consumers for service, on the ground that the companies have to earn a fair return on their investment, the Commission in many states also has control over the issuance of securities. Full power of review of state utility commission rulings and orders is vested in the courts, and, to the credit of commissions be it said, that nearly all of their decisions when attacked, have been sustained by the courts, the exceptions centering

around constitutional provisions against taking property without compensation and without due process of law.

Of course, reverence for utility commissions and confidence in their effectiveness, protection and security, depend on the manner in which the commissions comport themselves and on the degree to which they are responsive to the public will. It was inevitable that a revolutionary move such as was involved in bestowing regulatory powers on a commission, should meet with opposition at first. Experience shows that people do not take kindly to changes from forms to which they are accustomed. Every movement of this kind has a genesis, history and development quite its own and few reforms in government have ever been successful or permanently established otherwise than step by step and by slow degrees. The history of public utility regulation offers no exception. Normally our institutions are regarded as essentially practical, formed to meet actual human experiences and human needs under existing conditions and they ought, therefore, to be free from doubtful political innovation or speculative experimentation.

Bugaboo of Home Rule

Although in some quarters regulation is still looked upon as an experiment, fifteen years of it and the regularity with which commission decisions have been sustained in the courts indicate that public service commissions have established themselves as permanent American institutions. It is true that in many cities there has arisen from time to time strong objections to state regulation of public utilities on the ground that it violates the principle of municipal home rule. But so long as the state remains sovereign over municipalities it is bound to exercise a greater or less degree of control over that which is commonly known as "local service," regardless of whether such service is rendered by private corporations or the municipalities themselves, and the courts have invariably sustained this position.

The legal interpretation of the popular expression "home rule" is the right of the municipality to regulate and control local and municipal affairs under grant by legislative or constitutional provision. The courts have held almost unanimously that a grant of authority by the state to the municipality (a political subdivision of the state) to control its local and municipal affairs

does not include the regulation of public utilities, operating wholly or partially within the municipality, unless the grant goes beyond general expression and expressly names public utilities and the rates and service thereof. The highest courts of the land have held repeatedly that police power of the state should be jealously guarded and have always held that anything less than specific or expressed delegation of authority to the municipality shall be decided in favor of the state. Time after time the learned judges have commended the legislative body for its wisdom in providing for a regulated monopoly in public utility service; and have reasoned, it would seem with great wisdom, that the public welfare demanded the greatest expansion of electrical service at reasonable rates, linking together the city and country, ultimately bringing to the home, whether mansion, cottage, tenement or farmhouse, and to industry, regardless of size or location—whether store, factory, farm or mill, the great benefits of electrical service at the lowest cost consistent with the greatest expansion of service and the proper protection of the million and a half security holders, owning the electric light and power companies of the country.

Another and strong argument for utility control through the state rather than the municipality, is that very few cities can command the necessary legal, administrative and engineering staff for effective control, whereas this can readily be done by state commissions which at the same time accumulate such valuable data and a broad and varied experience, both of which are essential to efficient regulation. Thus regulation, to be fair to the public and to the electric light and power companies, must be more than local. It must be state-wide. Local regulation and control necessarily stifles suburban and rural development because the authority of the regulating power does not extend beyond the city limits. State regulation takes into consideration all elements and all factors, whether urban, suburban, or rural, and fixes rules and practices, service, standards and rates which should be fair and beneficial to all. It encourages the growth of the utility and the extension of its service to all points where that service is demanded, whenever and wherever such growth and extension is financially and physically possible and economically sound.

Regulation Should Be Progressive as Well as Corrective

There is no doubt but what the future success of utilities clearly depends on greater economy and efficiency and upon a large reduction in the ratio of expense to income. Much has already been done toward reducing expense by consolidations and interconnections of systems. During the war there were those who favored compulsory interconnection of properties, but they received little comfort in the shape of popular support because the public is desirous that the capital required to provide the facilities for the electrical demands of the future should come from private investors, and it is generally clear to anyone that only as economic conditions are favorable to consolidations will they take place, and then they will come about naturally as an evolution in the industry.

During the next few years the electric utilities will be given an opportunity to consolidate still further by voluntary action, and it will depend entirely on their financial condition whether the process be fast or slow. Under normal conditions the country may look to its electric public utilities to reach agreements and conclusions among themselves respecting the coordination of facilities and service or the introduction of economies essential to guaranteeing the most efficient administration and methods of distributing electricity nationally under private management. Such an achievement is easily possible under a rational system of commission regulation.

For over a decade now the American people have experienced the effects of regulation of public utilities. While particular questions to be solved change with variations in economic conditions, and with the evolution of political ideals and institutions, the basic question of how best to guarantee adequate and efficient service at just and reasonable rates may be said to be fairly understood. Upon numerous questions of public policy there may be marked differences of opinion, but as to the desirability of private ownership and operation of public utilities, there is no longer any confusion in the minds of the public because political ownership has proved a dismal failure.

On the other hand, if public utilities are to function efficiently in private hands, they must be placed on a stable and paying basis. They must have adequate equipment, funds for expansion to meet the growing needs of the communi-

ties they serve, and their securities must become attractive to the small investor as well as to the large banker. Any policy intended to stabilize the credit of utilities must involve a broader policy of rate regulation. The commissions if they are to determine the revenues of the utilities and sit in judgment upon the security issues, must establish rates that will enable the utilities to render efficient service and provide the country with a system of electrical supply capable of progressing with the development of the country. Any policy of rate control that stops short of this degree of responsibility on the part of the state would be inimical to the best interests of the utilities and of the communities they serve.

It is a truism that no community can develop faster than its utilities. Henceforth regulation must be progressive and efficient rather than merely corrective and negative in character.

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